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200 East Randolph Street
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958972

Ms. Jenny Davison
Ms. Margaret Gielniewski
Ms. Sarah Rolfes
Mr. Ross del Rosario
Mr. William Ryan
USEPA Region 5 – SR6J
77 W. Jackson Boulevard
Chicago, Illinois 60604-3590

RE: Multi-Site Risk Assessment Framework – Revision 6
North Shore Gas Company, Peoples Gas Light and Coke Company, and Wisconsin Public Service Corporation

Enclosed is the latest addendum to the human health risk screening levels (SLs) originally presented in the Multi-Site Risk Assessment Framework (RAF) for former manufactured gas plant sites, prepared for Wisconsin Public Service Corporation, Peoples Gas Light and Coke Company, and North Shore Gas Company in 2007.

Elements of this addendum supersede and replace those presented in the original RAF and previous versions of this RAF Addendum. The human health SLs have been updated to incorporate the July 2017 regional screening levels issued by the U.S. Environmental Protection Agency.

If you have any questions, please don't hesitate to contact me at (312) 240-4569 or nmprasad@integrysgroup.com.

Regards,

Naren M. Prasad, P.E., MPH
Principal Engineer – Environmental

Enclosures as noted

cc: Brian Bartoszek, Frank Dombrowski, Bob Paulson – WEC (email)
Paul Lake – IEPA (email)
Mike Kierski – Exponent (email)
Jennifer Hagen – NRT (email)

Exponent
1800 Diagonal Road, Suite 500
Alexandria, VA 22314

Risk Assessment Framework Addendum (Revision 6)

This document represents an addendum to the human health risk screening levels (SLs) originally presented in the Multi-Site Risk Assessment Framework (RAF) for former manufactured gas plant sites (MGPs), prepared for Wisconsin Public Service Corporation, Peoples Gas Light and Coke Company, and North Shore Gas Company (Exponent 2007). Elements of this addendum supersede and replace those presented in the original RAF (Exponent 2007) and previous versions of this RAF Addendum (Exponent 2011, 2014a,b, 2016a,b).

The human health SLs in this version of the RAF Addendum have been updated to incorporate the latest toxicology data provided by the U.S. Environmental Protection Agency (EPA) in 2017 to develop regional screening levels (RSLs). The EPA RSLs have become the standard SLs for the initial screening step in human health risk assessments. They are typically updated every six months; however, there had been no formal EPA update of the RSLs since May 2016 until June 2017. The June 2017 RSLs published by EPA were used to update this RAF Addendum (U.S. EPA 2017). In addition, vapor intrusion (VI) SLs, which were not presented in the RAF, are incorporated in this addendum. The VI SLs are based on the RSLs and were calculated using the most recent Vapor Intrusion Screening Level (VISL) Calculator developed by EPA (2016), which incorporates new information from the recently released *OSWER Technical Guide for Assessing and Mitigating the Vapor Intrusion Pathway from Subsurface Vapor Sources to Indoor Air* (U.S. EPA 2015). This RAF Addendum (Revision 6) updates the previous revision with the use of the most recent indoor air RSLs. A separate list of SLs is provided for Wisconsin and Illinois sites to reflect the differences between the States' regulations. The RAF Addendum (Revision 6) also provides updates for construction worker soil SLs specific to Illinois as needed (i.e., specifically some non-TACO values with new provisional toxicity information).

SLs for MGP-related constituents of potential concern (COPCs), presented in Table 1 of the RAF (Exponent 2007), are summarized by medium in this document. If other non-MGP-related analytes require consideration on a site-specific basis, human health SLs will be selected for those analytes using the processes specified in this addendum.

The human health SLs in this addendum will be updated as the sources presented in this document are updated (e.g., when new versions of RSLs or the VISL calculator become available) or if new sources of SLs become available in the future. As appropriate, an update to this document will be provided shortly after an update to one or more sources of SLs.

Hierarchy Used to Develop Human Health Screening Levels

Human health SLs are provided for soil, groundwater, and VI-related media (i.e., indoor air, soil gas, and groundwater) in this addendum. A hierarchical approach was used to select human health SLs by analyte within each medium. When an SL is available from the highest-tier source, values from lower-tier sources are not used.

Hierarchy for All Media other than Directly Contacted Groundwater—The RSL values (U.S. EPA 2017) are used as the first-tier source of SLs for soil and indoor air and as the basis for the VI-related SLs (i.e., soil gas and groundwater) calculated using the VISL calculator. For Illinois sites, State risk-based screening criteria are used as a second-tier (and sometimes third-tier) source of SLs to fill gaps where RSLs are unavailable. For Wisconsin sites, the State has transitioned to using RSLs as the basis of screening criteria for soil and VI-related media (indoor air and soil gas), as discussed further below; therefore, no second-tier screening criteria are used for soil or VI-related media.

Hierarchy for Directly Contacted Groundwater—For the groundwater direct-contact SLs, the site groundwater data will be compared separately to the tap water RSLs (U.S. EPA 2017), the federal maximum contaminant levels (MCLs) (U.S. EPA 2009), and state-promulgated drinking-water standards. As discussed in Section 5.2 of the RAF, these comparisons will be done to assess the potential risk if groundwater were to be used as a drinking-water source. The groundwater screening evaluation will be used in the baseline risk assessment only to determine whether concentrations of groundwater contaminants occur at levels that present a potential risk. The results of the groundwater screening will be documented in the risk assessment, but the risk assessment for this medium will not proceed beyond this screening step, because groundwater is not used as a drinking-water source at any of these sites. It is anticipated that the potential risk associated with groundwater will be assessed in the feasibility study, and if potential risks are present, they may be mitigated using risk management tools and/or remediation.

Medium-Specific Human Health Screening Levels

The methods used to develop and select the SLs by medium are presented in this section.

Soil Screening Levels

Soil SLs were selected separately for residential and industrial/commercial land use for both Wisconsin and Illinois MGP sites. For simplicity, the industrial/commercial SLs in this document and the associated tables are labeled as "industrial" SLs. The soil SLs for MGP sites located in Wisconsin are presented in Tables 1 and 2, and the soil SLs for MGP sites located in Illinois are presented in Tables 3 through 5. Specifically for Illinois MGP sites, a set of construction worker soil SLs, developed by the Illinois Environmental Protection Agency (Illinois EPA), have been included (Table 5). As described herein, many of the sources of soil SLs for residential and industrial receptors are the same for both states; however, separate tables are maintained to accommodate the small number of differences, described in the following sections, which exist between the two states in analyte-specific soil SLs.

MGP Sites in Wisconsin

The soil SLs for MGP sites in Wisconsin are presented in Table 1 (residential) and Table 2 (industrial). The Wisconsin Department of Natural Resources (WDNR) publishes a guidance document that recommends determining state-specific soil residual contaminant levels using the EPA RSL web calculator (WDNR 2017). This Wisconsin guidance recommends using EPA-provided default inputs for residential and industrial scenarios to estimate soil SLs, with the exception of the input for climatic zone. The climatic zone specified by the WDNR guidance as appropriate for Wisconsin sites is the Chicago zone. Because the default climatic zone used by

EPA in developing the RSLs will produce slightly lower concentrations than the Wisconsin recommended zone (Chicago) in some cases, this Addendum will adopt the default RSLs for MGP sites in Wisconsin for conservativeness. On a site-specific basis, region-specific SLs may be used. In these cases, the regional adjustments will be documented in the site-specific risk assessment, Site-Specific Work Plan (SSWP), or other relevant document.

For arsenic in Wisconsin soils, Wisconsin has developed a background threshold value (BTV) of 8 mg/kg based on extensive sampling by the U.S. Geological Survey (WDNR 2013a). Based on the direction provided in NR 720 and comments provided through EPA, this BTV will be used as the arsenic soil SL for MGP sites in Wisconsin (WDNR 2013b; U.S. EPA 2013a). The site-specific risk assessments will note that the BTV is higher than the risk-based values calculated for the RSLs (e.g., 0.68 mg/kg for residential and 3 mg/kg for industrial). Additionally, when there are one or more exceedances of the BTV, each site-specific risk assessment may document the risks associated with arsenic in two ways. Specifically, a calculation of total arsenic risk will be performed using the site concentration, as well as calculation of incremental arsenic risk above the BTV. If calculated, the incremental arsenic risk estimate will be provided in the uncertainty section of the baseline risk assessment.

The RSLs for each analyte are developed based on a target cancer risk of one in one million (1×10^{-6}) for carcinogenic chemicals or a target hazard quotient of one (1) for chemicals that elicit only noncancer effects (e.g., liver toxicity). Conservative default exposure assumptions that reflect either residential exposure or industrial worker exposure to soil are used, along with the target risk factors and toxicity values, to estimate the RSLs. When a chemical has the potential to cause cancer and noncancer toxicity effects, the lower of the two endpoint-specific values is used as the RSL. Additionally, if a risk-based concentration exceeds either the soil saturation concentration (Csat) or the ceiling limit of 100,000 mg/kg, the appropriate value will replace the risk-based concentration as the SL. For volatile compounds, the appropriate value will be the lower of the Csat or the ceiling limit, while for nonvolatile analytes the ceiling limit will be applied. This approach will be used for the purpose of selecting SLs that determine whether or not a constituent is selected as a COPC for further evaluation in the baseline risk assessment, but the risks estimated for the COPCs in the risk assessment will be based on the most current toxicity value available, as reflected in the RSL documentation.

For chromium and mercury, the RSL for the form most likely found at MGP sites was selected. Specifically, for chromium, the form present in soil depends on specific soil properties (e.g., eh, pH, mineralogy). In most soils, chromium is present predominantly as trivalent chromium (Cr^{3+}) (ATSDR 2012). Chromium may have been present at trace concentrations in MGP feedstock (i.e., coal or crude oil) at any MGP site (GRI 1996). However, combustion of these feedstocks results in emissions that contain only a small percentage (0.2%) of hexavalent chromium (Cr^{6+}) (ATSDR 2012). Thus, the RSL for Cr^{3+} was used as the SL. Mercury is a naturally occurring element that is usually found as mercuric sulfide (cinnabar), an insoluble, stable mercury salt, rather than as elemental mercury (ATSDR 1999). Because the most common form of mercury is mercuric sulfide, the RSL for mercury salts such as mercury sulfide is selected as the most appropriate RSL for mercury at MGP sites.

MGP Sites in Illinois

The soil SLs for Illinois sites are presented in Tables 3, 4, and 5. The first tier of the soil screening hierarchy for Illinois sites relies on the EPA RSLs as described for Wisconsin sites for the residential (Table 3) and industrial (Table 4) SLs. If an RSL was unavailable for either of these scenarios, a tiered approach to corrective action objectives (TACO) soil criterion developed by the Illinois EPA was used. This case did not occur for the residential or industrial SLs; however, the most current promulgated TACO values are summarized in Tables 3, 4, and 5 (Illinois EPA 2013a). TACO criteria have been developed for residents, commercial workers, and construction workers.

EPA does not have construction worker RSLs, so the construction worker TACO values were used as the first tier in the hierarchy for the construction worker soil SLs (Table 5). The TACO construction worker SLs were derived using exposure assumptions very different from those used to derive industrial/commercial TACO and industrial RSL screening values. The two biggest differences in exposure assumptions are related to the exposure frequency and the exposure duration. The exposure frequency for derivation of the industrial SLs is 250 days/year, whereas the exposure frequency used to derive the construction worker TACO values is 30 days/year. The exposure duration assumed for the industrial SLs (25 years) is much longer than that used to derive the construction worker TACO values (1 year). A site-specific construction worker risk evaluation is performed for each site in Illinois as specified in the *Construction Worker Evaluation* section of this document. The first step in each construction worker risk evaluation is an SL evaluation using the appropriate construction worker SL for each analyte. The lowest of the available construction worker TACO criteria (ingestion or inhalation routes) were used as the construction worker SL.

If a TACO construction worker value was unavailable, then a non-TACO value was derived using the 2017 Illinois EPA guidelines for construction workers (Illinois EPA 2017). Non-TACO values are developed using provisional toxicity values provided by Illinois EPA and are not promulgated soil standards within Illinois. The selection of construction worker non-TACO values followed the same scheme developed for TACO values (i.e., the lowest of the available ingestion- and inhalation-based values was selected for use in Table 5).

For arsenic in Illinois soils and residential and industrial receptors, TACO recommends using a background concentration rather than a risk-based value because the risk-based values are lower than background concentrations. The opposite is true for the construction worker, as the risk-based SLs are higher than Illinois background arsenic concentrations; therefore, the risk-based SL is applied in this case. Thus, in Tables 3 and 4, the SLs presented for arsenic are the background concentration for counties within the metropolitan statistical areas (13.0 mg/kg) and the background concentration for counties outside the metropolitan statistical areas (11.3 mg/kg) (Illinois EPA 2013a, Appendix A, Table G). The site-specific risk assessments will note that the Illinois background soil concentrations presented above are higher than the risk-based values calculated for the RSLs (i.e., 0.68 mg/kg for residential RSL and 3 mg/kg for industrial RSL). Additionally, when there are one or more exceedances of the applicable Illinois background arsenic concentration, each site-specific risk assessment may document the risks associated with arsenic in two ways. Specifically, a calculation of total arsenic risk will be performed using the site concentration as well as calculation of incremental arsenic risk above the background

concentration. If calculated, the incremental arsenic risk estimate will be provided in the uncertainty section of the baseline risk assessment.

It may be appropriate on a site-specific basis to use background criteria for polycyclic aromatic hydrocarbons (PAHs) in soils as another point of comparison in addition to the SLs. For example, some of the PAH SLs are below background PAH criteria for the City of Chicago (Exponent 2015). Such instances would be documented in the site-specific risk assessment and the full dataset would be compared to both the soil SLs and the soil background criteria. While background PAH comparisons may be made in the risk assessment, these comparisons will not be used to eliminate soil samples from further evaluation in the risk assessment and will only be presented in the uncertainty section of the risk assessment.

Groundwater Screening Levels

For screening groundwater at MGP sites in either Wisconsin or Illinois, the process will entail doing separate comparisons for each of three SLs: the tap water RSL (U.S. EPA 2017), the federal drinking-water standard (i.e., MCL) (U.S. EPA 2009), and the state-specific groundwater standard.

For Wisconsin sites, the state-specific regulation is the Wisconsin NR 140 Enforcement Standard (WDNR 2015a). For Illinois sites, the first tier of state-specific regulations is the Illinois Groundwater Quality Standards (Illinois EPA 2013b). For Illinois sites, the TACO groundwater remediation objectives will be used as a second tier for any analyte not listed in the groundwater quality standards, and the non-TACO groundwater remediation objective will be used as a third tier (Illinois EPA 2016). The groundwater SLs and their sources are summarized for each state in Tables 6 and 7.

Indoor Air Screening Levels

Indoor air SLs were selected separately for residential and industrial land use. Indoor air RSLs were used as the indoor air SLs for both Wisconsin and Illinois sites. These indoor air SLs will be used for indoor air investigations where the potential for VI into a building exists based on subsurface soil or groundwater contamination associated with former MGP-related operations. The indoor air RSLs are summarized in Tables 8 and 9 for both residential and industrial properties, respectively. The EPA indoor air RSLs (U.S. EPA 2017) are used for both Wisconsin and Illinois MGP sites, because at this time, Illinois has no promulgated indoor air risk-based screening values, and Wisconsin adopted the indoor air RSLs as their source of risk-based indoor air screening values in their VI guidance (WDNR 2015b).

Vapor Intrusion Screening Levels for Soil Gas and Groundwater

For evaluating the VI pathway, results from groundwater or soil gas samples collected below a building (i.e., sub-slab) and/or external to a building will be compared to the appropriate SLs described below. The process for evaluating the potential VI pathway using these results is provided in *Attachment 1: Vapor Intrusion Investigation Decision Matrix* (obtained from NRT 2016). For external samples collected outside a building in areas not covered by asphalt or concrete, efforts will be made to collect these samples from at least 5 ft below ground surface to minimize the potential for introducing ambient air into the soil gas sample. If site-specific

circumstances necessitate the collection of soil gas samples at depths of less than 5 ft (e.g., shallow depth of the water table), the data collected in this manner will be evaluated separately in the risk assessment rather than being dismissed. The reason for the shallow depth of the samples, and uncertainty associated with these shallower-than-ideal samples, will be clearly noted. The EPA-approved standard operating procedure (SOP) for soil gas sampling for the Multi-Site Program (SOP SAS-11-06) states that probes will be installed no shallower than 2 ft below ground surface.

The VI SLs for soil gas and groundwater were calculated using the most current version of EPA's VISL calculator (VISL-Calculator.xlsm, version 3.5.1, July 2016) which incorporates assumptions from the VI guidance (U.S. EPA 2015).[1] EPA updates the toxicity values in the VISL calculator each time they update the RSLs. The VI screening values from EPA are being used preferentially over the values provided in the Illinois TACO values (Illinois EPA 2013a) because the EPA values are noticeably lower and the attenuation factors used by EPA are based on an observational database rather than modeling.

The VISL calculator estimates the VI SL for each analyte by using the indoor air RSLs (residential or industrial) as a target air concentration, combined with a medium-specific (i.e., soil gas or groundwater)-to-building attenuation factor, plus an additional chemical-specific factor (Henry's Law constant) for groundwater.

The VI SLs for soil gas and groundwater (based on a groundwater temperature of 25°C) are presented in Tables 8 and 9. Only VI SLs for sufficiently volatile compounds with an inhalation toxicity value are summarized in these tables. Those compounds considered sufficiently volatile were determined based on their categorization in the RSL table as "volatile." The two criteria used to determine whether an analyte is volatile are the chemical's vapor pressure and its Henry's Law constant, as discussed in more detail in the new VI guidance (U.S. EPA 2015) and VISL calculator (Version 3.5.1, July 2016). Both parameters are also presented in the RSL documentation. The presence or absence of an inhalation toxicity value was also determined using the toxicity information presented in the RSL documentation. The VISL calculator automatically determines which analytes are both sufficiently volatile and have an inhalation toxicity value.

The attenuation factors listed below are currently used by the VISL calculator for derivation of the soil gas and groundwater VI SLs.

- Soil Gas 0.03
- Groundwater 0.001

These attenuation factors are presently recommended as conservative "generic" attenuation factors based on an analysis of a database of observations from residential buildings for purposes of developing the initial VI SLs (U.S. EPA 2015).

[1] The general methods EPA used to calculate the VI SLs are documented in the VISL User's Guide (U.S. EPA 2014). EPA has not yet updated the VISL User's Guide (as of July 7, 2017) to incorporate new assumptions from the most current VI guidance (U.S. EPA 2015) even though the VISL calculator has already been updated to incorporates these new assumptions.

If, on a site-specific basis, other less conservative attenuation factors appear appropriate, they will be used to update the initial VI screening analysis. One such possible site-specific instance might be when evaluating VI for a large building for which specific criteria are met (e.g., increased size of building, thickness of floor, and greater air exchange rate). In such a situation, an alternative set of attenuation factors might be incorporated if site-specific building characteristics can justify the use of less conservative (i.e., lower) attenuation factors. For example, WDNR has incorporated this flexibility in their current approach in the VI guidance (WDNR 2015b) for large commercial buildings where the building factors listed above (e.g., building size) are documented and can be used to substantiate the use of lower attenuation factors. In the case of the Wisconsin VI guidance, an attenuation factor 10-fold lower than the default value is applied to address the increased attenuation that occurs within larger buildings. Such alternative VI evaluations will be communicated to EPA on a site-specific basis, and the justification for their application will be documented in the remedial investigation work plan or other relevant document.

Soil gas SLs are calculated by the VISL calculator using the following equation:

$$\text{Soil gas VI SL } (\mu g/m^3) = \frac{\text{Indoor air RSL } (\mu g/m^3)}{\text{Soil gas attenuation factor (dimensionless)}}$$

Groundwater VI SLs are calculated by the VISL calculator using the following equation:

$$\text{Groundwater VI SL } (\mu g/L) = \text{Indoor air RSL } (\mu g/m^3) \times \frac{1}{\text{Groundwater attenuation factor}} \times \frac{1}{\text{Henry's Law constant (dimensionless)}} \times 0.001\ m^3/L$$

The groundwater VI SLs are generated by the VISL calculator assuming a default average groundwater temperature of 25ºC. This default value results in conservatively high groundwater VI SLs, because groundwater temperature is typically lower than 25ºC, and the volatility of a chemical from groundwater decreases as the groundwater temperature decreases. The VISL calculator allows the user to adjust the average temperature of the groundwater to a site-specific value. For this reason, the groundwater data will be reviewed on a site-specific basis, and if appropriate, an average groundwater temperature value will be derived and used in the VISL calculator to develop a site-specific set of groundwater VI SLs.

The VI SLs presented herein are based on a default target cancer risk of 1×10^{-6} and noncancer hazard quotient of 1 (Tables 8 and 9). For those analytes that can cause both carcinogenic and noncancer effects (e.g., benzene), the lower of the cancer- and noncancer-based SLs are presented in the screening tables.

Other conventions used by the VISL calculator are as follows:

- If the calculated target indoor air concentration is higher than the pure phase vapor concentration at 25ºC, then the calculator yields NVT (for not sufficiently volatile and/or toxic to pose inhalation risk in the selected exposure scenario for the indicated medium) instead of a concentration value.

- If the calculated target groundwater concentration is higher than the pure component water solubility, then the calculator yields NVT (for not sufficiently volatile and/or toxic to pose inhalation risk in the selected exposure scenario for the indicated medium) instead of a concentration value.

Cumulative Risk Check for Non-carcinogenic Effects

The SLs presented in this addendum for soil, indoor air, soil gas, and vapor migration from groundwater will be used as the first step in the human health screening process within the baseline risk assessment.[2] For each analyte, the maximum observed concentration will be compared to the SL to determine whether it should be carried forward into the baseline risk assessment as a COPC for further evaluation.

For chemicals exhibiting the potential for non-carcinogenic toxicity (noncarcinogens), an additional check will be performed to determine whether exposure to the multiple chemicals identified at the site will result in exceedance of the cumulative noncancer risk target (i.e., a hazard index of one). The process to perform this check is depicted in Figure 1.

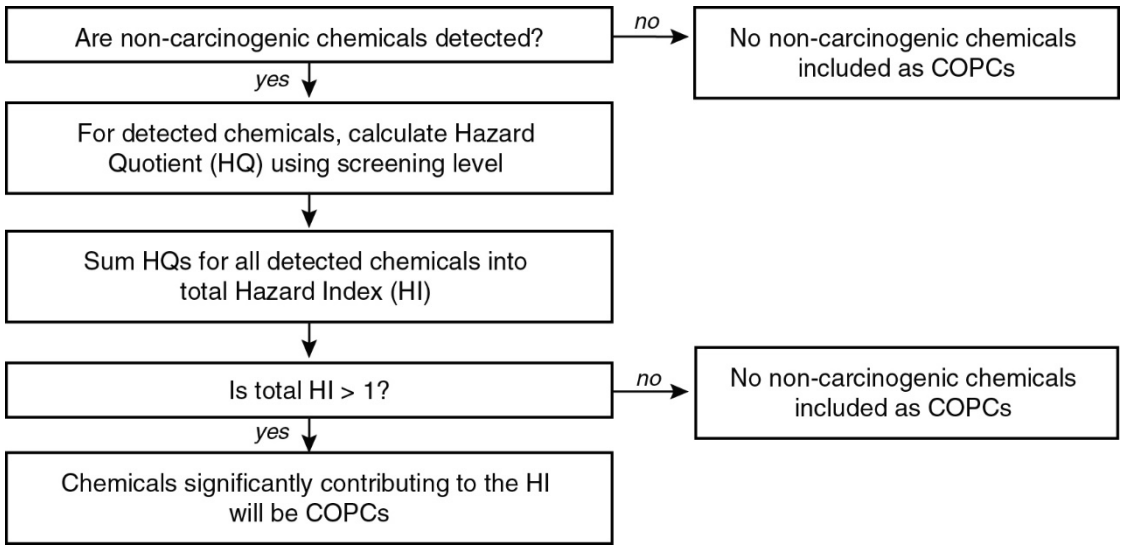


Figure 1. Screening check for cumulative non-carcinogenic effects

To perform the check, the maximum concentration of each noncarcinogen detected at the site will be divided by its medium-specific non-carcinogenic SL, and then these individual ratios (i.e., hazard quotients) will be summed across all noncarcinogens detected at the site. If the sum of the hazard quotients results in a hazard index exceeding the value of 1, those chemicals responsible for the exceedance will be carried forward for further evaluation within the baseline risk assessment, as described in Figure 1.

[2] Formal risk calculations for direct contact with groundwater will not be performed in the baseline risk assessment, because groundwater is not used as drinking water at any of these sites, so the special conditions discussed in this section do not apply for this exposure pathway.

Construction Worker Evaluation

Currently, EPA does not have construction worker-specific SLs to address potential risks to this receptor group. Typically, construction worker exposures at a Site are shorter than residential and industrial workers' exposures, so SLs considered protective of residential or industrial workers are in most cases thought to conservatively reflect concentration limits that would be protective of construction workers as well; however, in certain site-specific circumstances, construction workers may be exposed to certain media (e.g., NAPL, chemical vapors or soil gas, and groundwater) not reflected by the exposure pathways evaluated for developing residential or industrial worker SLs. For example, a construction worker may dig into the soils and perform work in an excavation that could potentially expose them to soil, groundwater, and chemical vapors in different ways from those assumed for the residential and industrial worker RSLs. In these instances, the residential or industrial-worker SLs may not reflect concentration limits that would be protective of construction workers. For MGP sites, the potential risks to future construction workers will be evaluated on a site-specific basis considering the environmental conditions at each MGP site and likely future land uses.

Specifically, the following process will be performed to evaluate risks to construction workers:

1. As the first step of the baseline risk assessment for Wisconsin and Illinois MGP sites, screening assessments for residential and industrial scenarios will be performed using the soil SLs and VISLs for soil gas in the most current multi-site RAF Addendum. For Illinois MGP sites, an additional soil screening assessment will be performed using the construction worker SLs. The residential soil SLs from the most current RAF Addendum will also be used to perform a screening assessment for sediments, unless sediment chemical concentrations are found to be comparable to ambient conditions (e.g., the sediment condition found in the adjacent river area at the North Branch MGP site).[3] This screening approach using the residential SLs for sediments has become a conservative practice for each of the multi-site program baseline risk assessments where the potential has existed for sediment exposure to recreational users. If chemical concentrations in the site sediment are not above ambient conditions, this will be documented in the risk assessment, and screening of sediments using the residential SLs will not be performed. Any constituents of potential concern (COPCs) identified in soil, soil gas, or sediment based on these screening assessments will be further evaluated quantitatively under a site-specific construction worker scenario (see Steps 2 and 3 below). In addition, locations where MGP residuals are identified onsite in soil or sediment will be further evaluated qualitatively in the risk assessment (see Step 4 below).

[3] Some of the Illinois TACO and non-TACO construction worker SLs are lower than the residential RSLs based on the assumptions used to model the volatilization of a chemical from unsaturated soil (i.e., soil with air-filled pore space between the soil particles where volatile chemicals can migrate). However, these inhalation values are not applicable to sediment exposures, because the sediment pore spaces are saturated with water which greatly reduces the potential for volatile chemicals to volatilize. For this reason, the Illinois construction worker inhalation-based SLs are not applied to sediments. The ingestion-based Illinois construction worker SLs are all higher than the residential RSLs, and so would be less conservative.

2. A site-specific characterization of the construction worker scenario will be performed for soils at each site where soil or soil gas COPCs are identified based on the results of Step 1. Site-specific conditions will affect the potential for construction workers' exposure to COPCs in soil and soil gas; also, exposure will be determined based on the types of construction projects feasible at the site (e.g., large building vs. small building or building with a basement vs. slab on grade). The construction worker scenario evaluation will also factor in any known planned future use of the site (e.g., a specific construction project). If the conditions for construction at the site vary by area (e.g., existing residential buildings in some areas and open commercial and/or industrial parcels in other areas), then the construction worker scenario will be tailored as appropriate for each area within the site to account for the area-specific conditions. Current EPA risk assessment guidance will be used to quantify the potential exposure and risk for construction workers at each site-specific area that requires evaluation.

3. A site-specific characterization of the construction worker scenario will be performed for sediments in water bodies potentially affected by site contaminants (i.e., areas where COPCs are identified in sediment above ambient conditions and residential SLs). The specific characteristics of the water body will affect the potential for construction worker exposure to COPCs in sediments; thus, the potential for exposure of construction workers to COPCs in sediment will be quantified considering the site-specific conditions of the water body. In addition, the risk associated with the potential construction worker sediment exposure will be quantified using current EPA risk assessment guidance.

4. Generally, when MGP residuals are encountered at a site (e.g., oil-wetted or -coated soils or sediment), they are logged in the field, but they are not typically analyzed for COPCs because they are considered to be clearly MGP affected and a potential environmental concern. The baseline risk assessment will include a qualitative evaluation of the potential risks to construction workers associated with exposures to MGP residuals in soil and sediments. Any potential for exposure to MGP residuals will be specifically called out as a potentially unacceptable risk to construction workers.

References

ATSDR. 1999. Toxicological profile for mercury. U.S. Department of Health and Human Services, Public Health Service, Agency for Toxic Substances and Disease Registry. Available at: http://www.atsdr.cdc.gov/toxprofiles/tp.asp?id=115&tid=24.

ATSDR. 2012. Toxicological profile for chromium. U.S. Department of Health and Human Services, Public Health Service, Agency for Toxic Substances and Disease Registry. Available at: http://www.atsdr.cdc.gov/toxprofiles/tp.asp?id=62&tid=17.

Exponent. 2007. Multi-site risk assessment framework, former manufactured gas plant sites. Revision 0. Prepared for Wisconsin Public Service Corporation, Peoples Gas Light and Coke Company, and North Shore Gas Company, Chicago, IL. Exponent, Alexandria, VA.

Exponent. 2011. Risk assessment framework, Addendum. Prepared for Wisconsin Public Service Corporation, Peoples Gas Light and Coke Company, and North Shore Gas Company, Chicago, IL. Exponent, Alexandria, VA.

Exponent. 2014a. Risk assessment framework addendum, Revision 2. Technical Memorandum. February 2014. Exponent, Maynard, MA.

Exponent. 2014b. Risk assessment framework addendum, Revision 3. Technical Memorandum. July 2014. Exponent, Maynard, MA.

Exponent. 2015. City of Chicago background soil data evaluation, Revision 0. Technical Report. December 2015. Exponent, Alexandria, Virginia.

Exponent. 2016a. Risk assessment framework addendum, Revision 4. Technical Memorandum. April 2016. Exponent, Maynard, MA.

Exponent. 2016b. Risk assessment framework addendum, Revision 5. Technical Memorandum. September 2016. Exponent, Alexandria, Virginia.

GRI. 1996. Management of manufactured gas plant sites: Two-volume practical reference guide from Gas Research Institute. Volume 1: Waste and chemicals of interest. Amherst Scientific Publishers. 599 pp.

Illinois 2013a. Title 35: Environmental protection, Subtitle G: Waste disposal, Chapter I: Pollution Control Board, Subchapter f: Risk based cleanup objectives, Part 742, Tiered approach to corrective action objectives. Available at: http://www.ipcb.state.il.us/SLR/IPCBandIEPAEnvironmentalRegulations-Title35.aspx. Effective July 15, 2013. Illinois Environmental Protection Agency.

Illinois EPA. 2013b. Title 35: Environmental protection, Subtitle F: Public water supplies, Chapter I: Pollution Control Board, Part 620, Groundwater quality. Available at: http://www.ipcb.state.il.us/SLR/IPCBandIEPAEnvironmentalRegulations-Title35.aspx. Effective October 7, 2013. Illinois Environmental Protection Agency.

Illinois EPA. 2016. Illinois non-TACO groundwater objectives. Available at: www.epa.state.il.us/land/taco/chemicals-not-in-taco-tier-1-tables.html. Illinois Environmental Protection Agency. Revision date March 31, 2016.

Illinois EPA. 2017. Illinois non-TACO objectives. Available at: http://www.epa.illinois.gov/topics/cleanup-programs/taco/index. Illinois Environmental Protection Agency.

NRT. 2016. Vapor Intrusion Investigation Decision Matrix and response to USEPA comments dated October 23, 2015. Prepared for Peoples Light and Coke Company, North Shore Gas Company, and Wisconsin Public Service Corporation. Prepared by Natural Resource Technology, Inc. January 15, 2016.

U.S. EPA. 2009. National primary drinking water standards. EPA 816-F-09-004. Available at http://water.epa.gov/drink/contaminants/index.cfm. U.S. Environmental Protection Agency. May.

U.S. EPA. 2014. Vapor intrusion screening level (VISL) calculator user's guide. Available at: http://www.epa.gov/oswer/vaporintrusion/guidance.html. U.S. Environmental Protection Agency, Office of Solid Waste and Emergency Response, Office of Superfund Remediation and Technology Innovation. May.

U.S. EPA. 2015 OSWER technical guide for assessing and mitigating the vapor intrusion pathway from subsurface vapor sources to indoor air. OSWER Publication 9200.2-154. U.S. Environmental Protection Agency, Office of Solid Waste and Emergency Response. June.

U.S. EPA. 2016a. Regional screening levels for chemical contaminants at Superfund sites. Available at: www.epa.gov/region/superfund/prg/index.html. Updated May 2016. U.S. Environmental Protection Agency, Regions 3, 6, and 9.

U.S. EPA. 2016b. Vapor intrusion screening level (VISL) calculator Version 3.5.1, updated July 2016. Available at: http://www.epa.gov/oswer/vaporintrusion/guidance.html. U.S. Environmental Protection Agency.

U.S. EPA. 2017. Regional Screening Levels (RSLs) - Generic Tables (June 2017). Available at: https://www.epa.gov/risk/regional-screening-levels-rsls-generic-tables-june-2017. Updated June 2017. U.S. Environmental Protection Agency.

WDNR. 2013a. Wisconsin Statewide Soil-Arsenic Background Threshold Value (RR-940). Available at: http://dnr.wi.gov/files/PDF/pubs/rr/RR940.pdf. Wisconsin Department of Natural Resources. July.

WDNR. 2013b. Chapter NR 720. Soil cleanup standards. Wisconsin Administrative Code Register, November 2013, No. 695. Wisconsin Department of Natural Resources.

WDNR. 2017. RR Program's RCL Spreadsheet Update (DNR-RR-052e). Available at: http://dnr.wi.gov/files/PDF/pubs/rr/RR052e.pdf. Wisconsin Department of Natural Resources. March 2017.

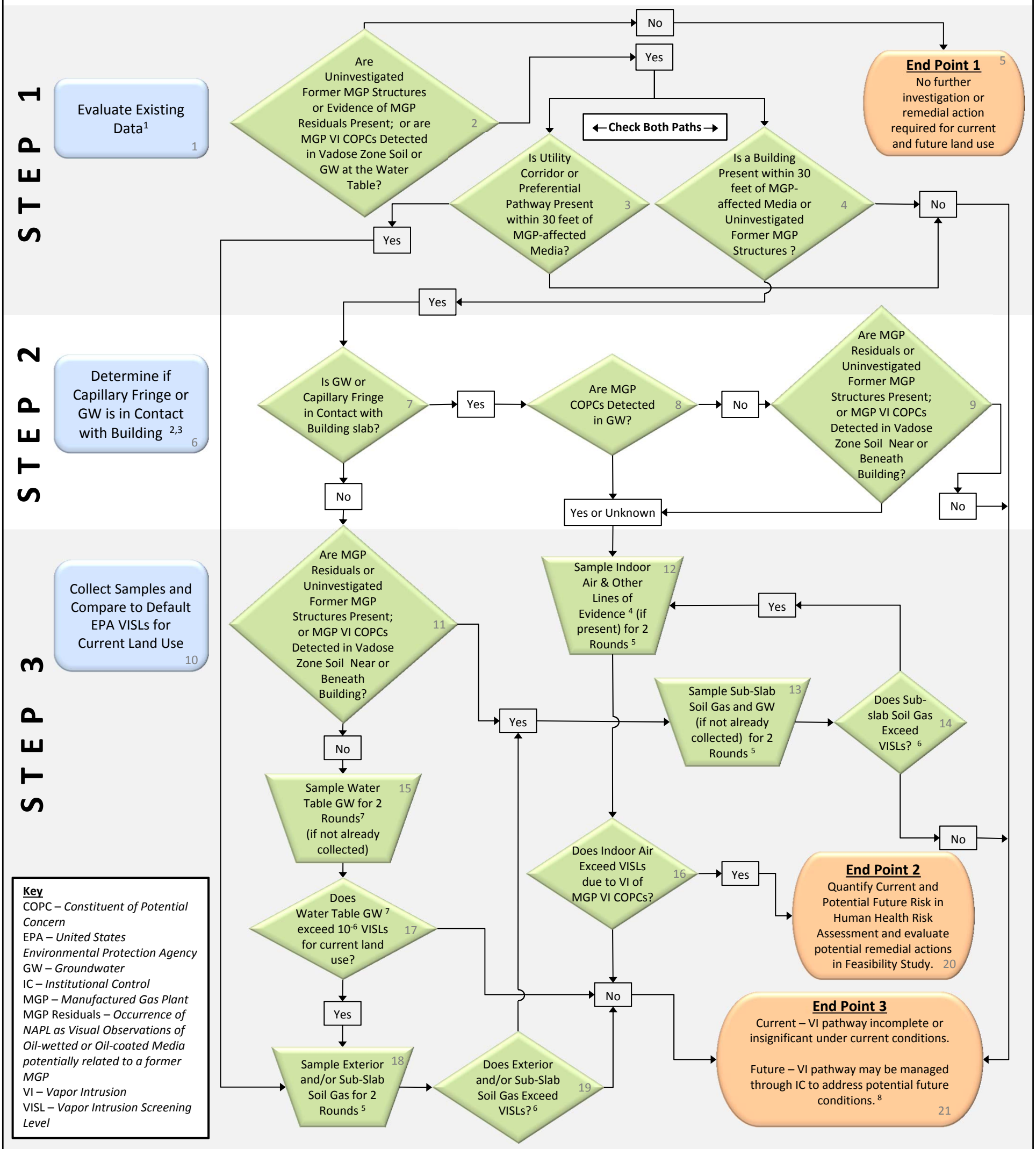
WDNR. 2015a. Chapter NR 140. Groundwater quality. Wisconsin Administrative Code Register, No. 715. Available at: http://docs.legis.wisconsin.gov/code/admin_code/nr/140.pdf. Wisconsin Department of Natural Resources. July.

WDNR. 2015b. Correspondence/Memorandum, Subject: Interim modifications to "Addressing vapor intrusion at remediation & redevelopment sites in Wisconsin" (RR-800) Update: Residential Sub-slab Attenuation Factor and Vapor Risk Screening Levels. Available at: http://dnr.wi.gov/files/PDF/pubs/rr/RR800.pdf. Wisconsin Department of Natural Resources. June 24, 2015.

Attachment 1

Vapor Intrusion Investigation Decision Matrix (January 15, 2016)

Figure 1 – Vapor Intrusion Investigation Decision Matrix (January 15, 2016)
North Shore Gas; Peoples Gas, Light and Coke; and Wisconsin Public Service Corporation
Multi-Site MGP Program



Key
COPC – *Constituent of Potential Concern*
EPA – *United States Environmental Protection Agency*
GW – *Groundwater*
IC – *Institutional Control*
MGP – *Manufactured Gas Plant*
MGP Residuals – *Occurrence of NAPL as Visual Observations of Oil-wetted or Oil-coated Media potentially related to a former MGP*
VI – *Vapor Intrusion*
VISL – *Vapor Intrusion Screening Level*

Notes

1: If previously collected GW and/or soil data exist, it should be used in this evaluation

2: Reference Johnson and Ettinger *Soil-Dependent Properties for The Vapor Intrusion Model, First Tier Assessment (EPA 530-D-02-004)* for guidance on estimating the height of the capillary fringe.

3: When determining if a building slab or utility corridor is in contact with the capillary fringe, the separation distance between the capillary fringe and the building will be evaluated using the lowest level of the building (i.e., basement if present) and the seasonal high water table beneath the building

4: Examples of "Other Lines of Evidence" could include sampling vapor in sumps or crawlspaces and/or sampling sub-slab vapor as supporting data to assist in evaluating source of indoor air concentrations, as appropriate.

5: One round should be collected during the heating season (November 15 through March 15) and one round should be collected during non-heating season to evaluate seasonal variation

6: If any sub-slab soil gas sample result is greater than a cancer risk of 10^{-6}, the need for indoor air sampling will be evaluated. If sub-slab sample results fall within the acceptable cancer risk range (10^{-4} to 10^{-6}) then professional judgment shall be used to determine if indoor air sampling will be completed. If indoor sampling is not proposed, rationale for the decision will be provided to USEPA for review and approval.

7: MGP VI COPC GW plume should be delineated within critical distance (30-feet) of building. Use lines of evidence to estimate GW quality and potential for VI at building

8: ICs may apply to existing buildings with no significant current VI pathway. In the event of modifications to building structure/use, GW or capillary fringe conditions, and/or land use modifications, the VI pathway may need to be re-evaluated. ICs may also apply to existing open space/vacant land with detections of MGP VI COPC in GW and/or vadose zone soil to address potential future conditions. Additional site-specific VI evaluations may be completed on these open/vacant spaces to rule out the need for ICs.

References

Integrys Business Support, LLC. (2008, September 5). *Series SAS-11, Soil Vapor Sampling and Measurement Procedures.*

Illinois Administrative Code. 2007. Title 35: Subtitle G: Waste Disposal, Chapter I: Pollution Control Board, Part 742, Tiered Approach to Corrective Action Objectives.

Natural Resource Technology, Inc (NRT). (2011, January 27). *December 17, 2010 Meeting Summary – Revision 1.*

NRT. (2015, November 23). *August 5, 2015 Meeting Summary – Revision 1.*

U.S. Environmental Protection Agency (EPA). (2015a, June). *OSWER Technical Guide For Assessing and Mitigating the Vapor Intrusion Pathway From Subsurface Vapor Sources to Indoor Air. OSWER Publication 9200.2-154.*

EPA. (2015b, June). *Technical Guide For Addressing Petroleum Vapor Intrusion At Leaking Underground Storage Tank Sites. EPA Publication 510-R-15-001.*

Wisconsin Department of Natural Resources (WDNR). (2015, June 24). *Bureau for Redevelopment and Remediation, Addressing Vapor Intrusion at Remediation & Redevelopment Sites in Wisconsin, DNR PUB-RR-800.*

WDNR. (2014, July). *Bureau for Redevelopment and Remediation, Sub-slab Vapor Sampling Procedures, DNR PUB-RR-986.*

Table 1. Residential soil screening levels for MGP sites in Wisconsin
RAF Addendum (Revision 6)

Analyte	CAS #	Selected Concentration: Soil Residential (mg/kg)	Source	Comments	U.S. EPA (2017) RSL Soil Residential (mg/kg)	Soil Saturation Concentration C_{sat} (mg/kg)
Semivolatile Organic Compounds						
Polycyclic Aromatic Hydrocarbons						
Acenaphthene	83-32-9	3,600 n	RSL		3,600 n	--
Acenaphthylene	208-96-8	3,600 n	RSL	Used surrogate of acenaphthene (83-32-9)	3,600 n	--
Anthracene	120-12-7	18,000 n	RSL		18,000 n	--
Benzo[a]anthracene	56-55-3	1.1 c	RSL		1.1 c	--
Benzo[a]pyrene	50-32-8	0.11 c	RSL		0.11 c	--
Benzo[b]fluoranthene	205-99-2	1.1 c	RSL		1.1 c	--
Benzo[g,h,i]perylene	191-24-2	1,800 n	RSL	Used surrogate of pyrene (129-00-0)	1,800 n	--
Benzo[k]fluoranthene	207-08-9	11 c	RSL		11 c	--
Chrysene	218-01-9	110 c	RSL		110 c	--
Dibenz[a,h]anthracene	53-70-3	0.11 c	RSL		0.11 c	--
Fluoranthene	206-44-0	2,400 n	RSL		2,400 n	--
Fluorene	86-73-7	2,400 n	RSL		2,400 n	--
Indeno[1,2,3-cd]pyrene	193-39-5	1.1 c	RSL		1.1 c	--
2-Methylnaphthalene	91-57-6	240 n	RSL		240 n	--
Naphthalene	91-20-3	3.8 c*	RSL		3.8 c*	--
Phenanthrene	85-01-8	18,000 n	RSL	Used surrogate of anthracene (120-12-7)	18,000 n	--
Pyrene	129-00-0	1,800 n	RSL		1,800 n	--
Phenols						
2,4-Dimethylphenol	105-67-9	1,300 n	RSL		1,300 n	--
2-Methylphenol (o-Cresol)	95-48-7	3,200 n	RSL		3,200 n	--
3&4-Methylphenol (m&p)	108-39-4	3,200 n	RSL	Used value for m-cresol (108-39-4)	3,200 n	--
Phenol	108-95-2	19,000 n	RSL		19,000 n	--
Volatile Organic Compounds						
Benzene	71-43-2	1.2 c*	RSL		1.2 c*	1,820
Ethylbenzene	100-41-4	5.8 c	RSL		5.8 c	480
Toluene	108-88-3	818 n	sat		4,900 ns	818
1,2,4-Trimethylbenzene	95-63-6	219 n	sat		300 ns	219
1,3,5-Trimethylbenzene	108-67-8	182 n	sat		270 ns	182
m&p-Xylene	108-38-3	388 n	sat	Used value for m-xylene (108-38-3)	550 ns	388
o-Xylene	95-47-6	434 n	sat		650 ns	434
Xylene (Total)	1330-20-7	260 n	sat		580 ns	260
Metals and Inorganics						
Aluminum	7429-90-5	77,000 n	RSL		77,000 n	--
Antimony	7440-36-0	31 n	RSL	Antimony (metallic)	31 n	--
Arsenic	7440-38-2	8.0	background[1]	Arsenic, inorganic	0.68 c*	--
Barium	7440-39-3	15,000 n	RSL		15,000 n	--
Cadmium	7440-43-9	71 n	RSL	Dietary value	71 n	--
Chromium	7440-47-3	100,000 n	max	Cr(III) for soil	120,000 nm	--
Copper	7440-50-8	3,100 n	RSL		3,100 n	--
Iron	7439-89-6	55,000 n	RSL		55,000 n	--
Lead	7439-92-1	400	RSL		400	--
Manganese	7439-96-5	1,800 n	RSL	Used non-dietary value	1,800 n	--
Mercury	7487-94-7	23 n	RSL	Used Hg chloride (& other Hg salts) (7487-94-7)	23 n	--
Nickel	7440-02-0	1,500 n	RSL	Nickel soluble salts	1,500 n	--
Selenium	7782-49-2	390 n	RSL		390 n	--
Silver	7440-22-4	390 n	RSL		390 n	--
Vanadium	7440-62-2	390 n	RSL		390 n	--
Zinc	7440-66-6	23,000 n	RSL		23,000 n	--
Cyanide	57-12-5	78 n	RSL	Used sodium cyanide (143-33-9)	78 n	--

Notes: This table provides the selected screening value for each analyte. If the risk-based concentration exceeds either the soil saturation concentration (C_{sat}) or the ceiling limit of 100,000 mg/kg, the appropriate value replaces the risk-based concentration as the screening level. For arsenic, the risk-based concentration is lower than state-specific soil background values, as will be documented in the baseline risk assessment. Consistent with EPA risk assessment guidance (U.S. EPA 1989; RAGs Part A), the state-specific background value will be used as the screening level for arsenic at MGP sites. The source of the selected screening value is presented to the right of the numerical value.

RSLs: The residential soil RSLs were publisehd by EPA June 2017 (https://www.epa.gov/risk/regional-screening-levels-rsls-generic-tables-june-201

- c – screening value based on cancer effects; calculated values correspond to a cancer risk level of 1 in 1,000,000
- c* – where the non-cancer screening level is < 100× cancer screening level
- m – concentration may exceed ceiling limit
- max – risk-based concentration above ceiling limit, so value was set to ceiling limit (100,000 mg/kg)
- n – screening value based on non-cancer effects; calculated values correspond to a target hazard quotient of 1
- s – concentration may exceed C_{sat} (soil saturation concentration)
- sat – risk-based concentration exceeded soil saturation concentration (C_{sat}), so value was set to C_{sat}.

[1] Concentration is the background threshold value (BTV) for Wisconsin, determined by Wisconsin Department of Natural Resources (WDNR 2013a).

Table 2. Industrial soil screening levels for MGP sites in Wisconsin
RAF Addendum (Revision 6)

Analyte	CAS #	Selected Concentration Soil Industrial (mg/kg)	Source	Comments	U.S. EPA (2017) RSL Soil Industrial (mg/kg)	Soil Saturation Concentration C_{sat} (mg/kg)
Semivolatile Organic Compounds						
Polycyclic Aromatic Hydrocarbons						
Acenaphthene	83-32-9	45,000 n	RSL		45,000 n	--
Acenaphthylene	208-96-8	45,000 n	RSL	Used surrogate of acenaphthene (83-32-9)	45,000 n	--
Anthracene	120-12-7	100,000 n	max		230,000 nm	--
Benzo[a]anthracene	56-55-3	21 c	RSL		21 c	--
Benzo[a]pyrene	50-32-8	2.1 c	RSL		2.1 c	--
Benzo[b]fluoranthene	205-99-2	21 c	RSL		21 c	--
Benzo[g,h,i]perylene	191-24-2	23,000 n	RSL	Used surrogate of pyrene (129-00-0)	23,000 n	--
Benzo[k]fluoranthene	207-08-9	210 c	RSL		210 c	--
Chrysene	218-01-9	2,100 c	RSL		2,100 c	--
Dibenz[a,h]anthracene	53-70-3	2.1 c	RSL		2.1 c	--
Fluoranthene	206-44-0	30,000 n	RSL		30,000 n	--
Fluorene	86-73-7	30,000 n	RSL		30,000 n	--
Indeno[1,2,3-cd]pyrene	193-39-5	21 c	RSL		21 c	--
2-Methylnaphthalene	91-57-6	3,000 n	RSL		3,000 n	--
Naphthalene	91-20-3	17 c*	RSL		17 c*	--
Phenanthrene	85-01-8	100,000 n	max	Used surrogate of anthracene (120-12-7)	230,000 nm	--
Pyrene	129-00-0	23,000 n	RSL		23,000 n	--
Phenols						
2,4-Dimethylphenol	105-67-9	16,000 n	RSL		16,000 n	--
2-Methylphenol (o-Cresol)	95-48-7	41,000 n	RSL		41,000 n	--
3&4-Methylphenol (m&p)	108-39-4	41,000 n	RSL	Used value for m-cresol (108-39-4)	41,000 n	--
Phenol	108-95-2	100,000 n	max		250,000 nm	--
Volatile Organic Compounds						
Benzene	71-43-2	5.1 c*	RSL		5.1 c*	1,820
Ethylbenzene	100-41-4	25 c	RSL		25 c	480
Toluene	108-88-3	818 n	sat		47,000 ns	818
1,2,4-Trimethylbenzene	95-63-6	219 n	sat		1,800 ns	219
1,3,5-Trimethylbenzene	108-67-8	182 n	sat		1,500 ns	182
m&p-Xylene	108-38-3	388 n	sat	Used value for m-xylene (108-38-3)	2,400 ns	388
o-Xylene	95-47-6	434 n	sat		2,800 ns	434
Xylene (Total)	1330-20-7	260 n	sat		2,500 ns	260
Metals and Inorganics						
Aluminum	7429-90-5	100,000 n	max		1,100,000 nm	--
Antimony	7440-36-0	470 n	RSL	Antimony (metallic)	470 n	--
Arsenic	7440-38-2	8.0	background[1]	Arsenic, inorganic	3.0 c	--
Barium	7440-39-3	100,000 n	max		220,000 nm	--
Cadmium	7440-43-9	980 n	RSL	Dietary value	980 n	--
Chromium	7440-47-3	100,000 n	max	Cr(III) for soil	1,800,000 nm	--
Copper	7440-50-8	47,000 n	RSL		47,000 n	--
Iron	7439-89-6	100,000 n	max		820,000 nm	--
Lead	7439-92-1	800	RSL		800	--
Manganese	7439-96-5	26,000 n	RSL	Used non-dietary value	26,000 n	--
Mercury	7487-94-7	350 n	RSL	Used Hg chloride (& other Hg salts) (7487-94-7)	350 n	--
Nickel	7440-02-0	22,000 n	RSL	Nickel soluble salts	22,000 n	--
Selenium	7782-49-2	5,800 n	RSL		5,800 n	--
Silver	7440-22-4	5,800 n	RSL		5,800 n	--
Vanadium	7440-62-2	5,800 n	RSL		5,800 n	--
Zinc	7440-66-6	100,000 n	max		350,000 nm	--
Cyanide	57-12-5	1,200 n	RSL	Used sodium cyanide (143-33-9)	1,200 n	--

Notes: This table provides the selected screening value for each analyte. If the risk-based concentration exceeds either the soil saturation concentrat (C_{sat}) or the ceiling limit of 100,000 mg/kg, the appropriate value replaces the risk-based concentration as the screening level. For arsenic, the risk-based concentration is lower than state-specific soil background values, as will be documented in the baseline risk assessment. Consistent with EPA risk assessment guidance (U.S. EPA 1989; RAGs Part A), the state-specific background value will be used as the screer level for arsenic at MGP sites. The source of the selected screening value is presented to the right of the numerical value.

RSLs: The industrial soil RSLs were publisehd by EPA June 2017 (https://www.epa.gov/risk/regional-screening-levels-rsls-generic-tables-june-2017).

- c – screening value based on cancer effects; calculated values correspond to a cancer risk level of 1 in 1,000,000
- c* – where the non-cancer screening level is < 100× cancer screening level
- m – concentration may exceed ceiling limit
- max – risk-based concentration above ceiling limit, so value was set to ceiling limit (100,000 mg/kg)
- n – screening value based on non-cancer effects; calculated values correspond to a target hazard quotient of 1
- s – concentration may exceed C_{sat} (soil saturation concentration)
- sat – risk-based concentration exceeded soil saturation concentration (C_{sat}), so value was set to C_{sat}.

[1] Concentration is the background threshold value (BTV) for Wisconsin, determined by Wisconsin Department of Natural Resources (WDNR 2013a).

Table 3. Residential soil screening levels for MGP sites in Illinois
RAF Addendum (Revision 6)

Analyte	CAS #	Selected Concentration: Soil Residential (mg/kg)	Source	Comments	U.S. EPA (2017) RSL Soil Residential (mg/kg)	Soil Saturation Concentration C_{sat} (mg/kg)	IEPA (2013c) TACO Remediation Objective Soil, Residential: Ingestion (mg/kg)	IEPA (2013c) TACO Remediation Objective Soil, Residential: Inhalation (mg/kg)
Semivolatile Organic Compounds								
Polycyclic Aromatic Hydrocarbons								
Acenaphthene	83-32-9	3,600 n	RSL		3,600 n	--	4,700 n	--
Acenaphthylene	208-96-8	3,600 n	RSL	Used surrogate of acenaphthene (83-32-9)	3,600 n	--	--	--
Anthracene	120-12-7	18,000 n	RSL		18,000 n	--	23,000 n	--
Benzo[a]anthracene	56-55-3	1.1 c	RSL		1.1 c	--	0.9 c,w	--
Benzo[a]pyrene	50-32-8	0.11 c	RSL		0.11 c	--	0.09 c,w	--
Benzo[b]fluoranthene	205-99-2	1.1 c	RSL		1.1 c	--	0.9 c,w	--
Benzo[g,h,i]perylene	191-24-2	1,800 n	RSL	Used surrogate of pyrene (129-00-0)	1,800 n	--	--	--
Benzo[k]fluoranthene	207-08-9	11 c	RSL		11 c	--	9 c	--
Chrysene	218-01-9	110 c	RSL		110 c	--	88 c	--
Dibenz[a,h]anthracene	53-70-3	0.11 c	RSL		0.11 c	--	0.09 c,w	--
Fluoranthene	206-44-0	2,400 n	RSL		2,400 n	--	3,100 n	--
Fluorene	86-73-7	2,400 n	RSL		2,400 n	--	3,100 n	--
Indeno[1,2,3-cd]pyrene	193-39-5	1.1 c	RSL		1.1 c	--	0.9 c,w	--
2-Methylnaphthalene	91-57-6	240 n	RSL		240 n	--	--	--
Naphthalene	91-20-3	3.8 c*	RSL		3.8 c*	--	1,600 n	170 n
Phenanthrene	85-01-8	18,000 n	RSL	Used surrogate of anthracene (120-12-7)	18,000 n	--	--	--
Pyrene	129-00-0	1,800 n	RSL		1,800 n	--	2,300 n	--
Phenols								
2,4-Dimethylphenol	105-67-9	1,300 n	RSL		1,300 n	--	1,600 n	--
2-Methylphenol (o-Cresol)	95-48-7	3,200 n	RSL		3,200 n	--	3,900 n	--
3&4-Methylphenol (m&p)	108-39-4	3,200 n	RSL	Used value for m-cresol (108-39-4)	3,200 n	--	--	--
Phenol	108-95-2	19,000 n	RSL		19,000 n	--	23,000 n	--
Volatile Organic Compounds								
Benzene	71-43-2	1.2 c*	RSL		1.2 c*	1,820	12 c	0.8 c
Ethylbenzene	100-41-4	5.8 c	RSL		5.8 c	480	7,800 n	400 d
Toluene	108-88-3	818 n	sat		4,900 ns	818	16,000 n	650 d
1,2,4-Trimethylbenzene	95-63-6	219 n	sat		300 ns	219	--	--
1,3,5-Trimethylbenzene	108-67-8	182 n	sat		270 ns	182	--	--
m&p-Xylene	108-38-3	388 n	sat	Used value for m-xylene (108-38-3)	550 ns	388	16,000 n	420 d
o-Xylene	95-47-6	434 n	sat		650 ns	434	16,000 n	410 d
Xylene (Total)	1330-20-7	260 n	sat		580 ns	260	16,000 n	320 d
Metals and Inorganics								
Aluminum	7429-90-5	77,000 n	RSL		77,000 n	--	--	--
Antimony	7440-36-0	31 n	RSL	Antimony (metallic)	31 n	--	31 n	--
Arsenic	7440-38-2	13.0 / 11.3	background[1]	Arsenic, inorganic	0.68 c*	--	13.0 / 11.3 t	750 c
Barium	7440-39-3	15,000 n	RSL		15,000 n	--	5,500 n	690,000 n
Cadmium	7440-43-9	71 n	RSL	Dietary value	71 n	--	78 n,r	1,800 c
Chromium	7440-47-3	100,000 n	max	Cr(III) for soil	120,000 nm	--	230 n	270 c
Copper	7440-50-8	3,100 n	RSL		3,100 n	--	2,900 n	--
Iron	7439-89-6	55,000 n	RSL		55,000 n	--	--	--
Lead	7439-92-1	400	RSL		400	--	400 k	--
Manganese	7439-96-5	1,800 n	RSL	Used non-dietary value	1,800 n	--	1,600 n,v	69,000 n
Mercury	7487-94-7	23 n	RSL	Used Hg chloride (& other Hg salts) (7487-94-7)	23 n	--	23 n	--
Nickel	7440-02-0	1,500 n	RSL	Nickel soluble salts	1,500 n	--	1,600 n	13,000 c
Selenium	7782-49-2	390 n	RSL		390 n	--	390 n	--
Silver	7440-22-4	390 n	RSL		390 n	--	390 n	--
Vanadium	7440-62-2	390 n	RSL		390 n	--	550 n	--
Zinc	7440-66-6	23,000 n	RSL		23,000 n	--	23,000 n	--
Cyanide	57-12-5	78 n	RSL	Used sodium cyanide (143-33-9)	78 n	--	1,600 n	--

(footnotes on following page)

Table 3. Residential soil screening levels for MGP sites in Illinois
RAF Addendum (Revision 6)

Notes: This table provides the selected screening value for each analyte. If the risk-based concentration exceeds either the soil saturation concentration (C_{sat}) or the ceiling limit of 100,000 mg/kg, the appropriate value replaces the risk-based concentration as the screening level. For arsenic, the risk-based concentration is lower than state-specific soil background values, as will be documented in the baseline risk assessment. Consistent with EPA risk assessment guidance (U.S. EPA 1989; RAGs Part A), the state-specific background value will be used as the screening level for arsenic at MGP sites. The source of the selected screening value is presented to the right of the numerical value.

Hierarchy for soil screening criteria:
RSL, then TACO value.
For all TACO soil remediation objectives, the lowest of the two pathway-specific (i.e., ingestion or inhalation) values is used.

RSLs: The residential soil RSLs were publisehd by EPA June 2017 (https://www.epa.gov/risk/regional-screening-levels-rsls-generic-tables-june-2017).

TACO
Illinois Tiered Approach to Corrective Action Objectives (TACO), soil remediation objectives, Title 35 Part 742 (IEPA 2013c) (http://www.ipcb.state.il.us/SLR/IPCBandIEPAEnvironmentalRegulations-Title35.aspx)

- c – screening value based on cancer effects; calculated values correspond to a cancer risk level of 1 in 1,000,000
- c* – where the non-cancer screening level is < 100× cancer screening level
- d – soil saturation concentration (C_{sat}) – the concentration at which the absorptive limits of the soil particles, the solubility limits of the available soil moisture, and saturation of soil pore air have been reached; – above the soil saturation concentration, the assumptions regarding vapor transport to air and/or dissolved phase transport to groundwater (for chemicals which are liquid at ambient soil temperatures) – have been violated, and alternative modeling approaches are required
- m – concentration may exceed ceiling limit
- max – risk-based concentration above ceiling limit, so value was set to ceiling limit (100,000 mg/kg)
- n – screening value based on non-cancer effects; calculated values correspond to a target hazard quotient of 1
- s – concentration may exceed C_{sat} (soil saturation concentration)
- sat – risk-based concentration exceeded soil saturation concentration (C_{sat}), so value was set to C_{sat}.
- k – a preliminary remediation goal of 400 mg/kg has been set for lead based on *Revised Interim Soil Lead Guidance for CERCLA Sites and RCRA Corrective Action Facilities* , OSWER Directive #9355.4-12
- r – value based on dietary reference dose
- t – values for counties within metropolitan statistical area (13.0 mg/kg) and outside metropolitan statistical area (11.3 mg/kg) from 742.Appendix A, Table G [Concentrations of Inorganic Chemicals in Background Soi
- v – value based on reference dose adjusted for dietary intake
- w – for sites located in any populated area as defined in Section 742.200, Appendix A, Table H may be used [Concentrations of Polynuclear Aromatic Hydrocarbon Chemicals in Background Soils]; see text for details

[1] Concentrations are the Illinois background concentrations for arsenic from TACO. Values for counties within metropolitan statistical area (13.0 mg/kg) and outside metropolitan statistical area (11.3 mg/kg) are taken from IEPA 2013c, 742.Appendix A, Table G [Concentrations of Inorganic Chemicals in Background Soils].

Table 4. Industrial soil screening levels for MGP sites in Illinois
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Analyte	CAS #	Selected Concentration Soil Industrial (mg/kg)	Source	Comments	U.S. EPA (2017) RSL Soil Industrial (mg/kg)	Soil Saturation Concentration C_{sat} (mg/kg)	IEPA (2013c) TACO Remediation Objective Soil, Industrial/Commercial Ingestion (mg/kg)	Inhalation (mg/kg)
Semivolatile Organic Compounds								
Polycyclic Aromatic Hydrocarbons								
Acenaphthene	83-32-9	45,000 n	RSL		45,000 n	--	120,000 n	--
Acenaphthylene	208-96-8	45,000 n	RSL	Used surrogate of acenaphthene (83-32-9)	45,000 n	--	--	--
Anthracene	120-12-7	100,000 n	max		230,000 nm	--	610,000 n	--
Benzo[a]anthracene	56-55-3	21 c	RSL		21 c	--	8 c	--
Benzo[a]pyrene	50-32-8	2.1 c	RSL		2.1 c	--	0.8 c,x	--
Benzo[b]fluoranthene	205-99-2	21 c	RSL		21 c	--	8 c	--
Benzo[g,h,i]perylene	191-24-2	23,000 n	RSL	Used surrogate of pyrene (129-00-0)	23,000 n	--	--	--
Benzo[k]fluoranthene	207-08-9	210 c	RSL		210 c	--	78 c	--
Chrysene	218-01-9	2,100 c	RSL		2,100 c	--	780 c	--
Dibenz[a,h]anthracene	53-70-3	2.1 c	RSL		2.1 c	--	0.8 c	--
Fluoranthene	206-44-0	30,000 n	RSL		30,000 n	--	82,000 n	--
Fluorene	86-73-7	30,000 n	RSL		30,000 n	--	82,000 n	--
Indeno[1,2,3-cd]pyrene	193-39-5	21 c	RSL		21 c	--	8 c	--
2-Methylnaphthalene	91-57-6	3,000 n	RSL		3,000 n	--	--	--
Naphthalene	91-20-3	17 c*	RSL		17 c*	--	41,000 n	270 n
Phenanthrene	85-01-8	100,000 n	max	Used surrogate of anthracene (120-12-7)	230,000 nm	--	--	--
Pyrene	129-00-0	23,000 n	RSL		23,000 n	--	61,000 n	--
Phenols								
2,4-Dimethylphenol	105-67-9	16,000 n	RSL		16,000 n	--	41,000 n	--
2-Methylphenol (o-Cresol)	95-48-7	41,000 n	RSL		41,000 n	--	100,000 n	--
3&4-Methylphenol (m&p)	108-39-4	41,000 n	RSL	Used value for m-cresol (108-39-4)	41,000 n	--	--	--
Phenol	108-95-2	100,000 n	max		250,000 nm	--	610,000 n	--
Volatile Organic Compounds								
Benzene	71-43-2	5.1 c*	RSL		5.1 c*	1,820	100 c	1.6 c
Ethylbenzene	100-41-4	25 c	RSL		25 c	480	200,000 n	400 d
Toluene	108-88-3	818 n	sat		47,000 ns	818	410,000 n	650 d
1,2,4-Trimethylbenzene	95-63-6	219 n	sat		1,800 ns	219	--	--
1,3,5-Trimethylbenzene	108-67-8	182 n	sat		1,500 ns	182	--	--
m&p-Xylene	108-38-3	388 n	sat	Used value for m-xylene (108-38-3)	2,400 ns	388	410,000 n	420 d
o-Xylene	95-47-6	434 n	sat		2,800 ns	434	410,000 n	410 d
Xylene (Total)	1330-20-7	260 n	sat		2,500 ns	260	410,000 n	320 d
Metals and Inorganics								
Aluminum	7429-90-5	100,000 n	max		1,100,000 nm	--	--	--
Antimony	7440-36-0	470 n	RSL	Antimony (metallic)	470 n	--	820 n	--
Arsenic	7440-38-2	13.0 / 11.3	background[1]	Arsenic, inorganic	3.0 c	--	13.0 / 11.3 t	1,200 c
Barium	7440-39-3	100,000 n	max		220,000 nm	--	140,000 n	910,000 n
Cadmium	7440-43-9	980 n	RSL	Dietary value	980 n	--	2,000 n,r	2,800 c
Chromium	7440-47-3	100,000 n	max	Cr(III) for soil	1,800,000 nm	--	6,100 n	420 c
Copper	7440-50-8	47,000 n	RSL		47,000 n	--	82,000 n	--
Iron	7439-89-6	100,000 n	max		820,000 nm	--	--	--
Lead	7439-92-1	800	RSL		800	--	800 y	--
Manganese	7439-96-5	26,000 n	RSL	Used non-dietary value	26,000 n	--	41,000 n,w	91,000 n
Mercury	7487-94-7	350 n	RSL	Used Hg chloride (& other Hg salts) (7487-94-7)	350 n	--	610 n	16 n
Nickel	7440-02-0	22,000 n	RSL	Nickel soluble salts	22,000 n	--	41,000 n	21,000 c
Selenium	7782-49-2	5,800 n	RSL		5,800 n	--	10,000 n	--
Silver	7440-22-4	5,800 n	RSL		5,800 n	--	10,000 n	--
Vanadium	7440-62-2	5,800 n	RSL		5,800 n	--	14,000 n	--
Zinc	7440-66-6	100,000 n	max		350,000 nm	--	610,000 n	--
Cyanide	57-12-5	1,200 n	RSL	Used sodium cyanide (143-33-9)	1,200 n	--	41,000 n	--

(footnotes on following page)

Table 4. Industrial soil screening levels for MGP sites in Illinois
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Notes: This table provides the selected screening value for each analyte. If the risk-based concentration exceeds either the soil saturation concentration (C_{sat}) or the ceiling limit of 100,000 mg/kg, the appropriate value replaces the risk-based concentration as the screening level. For arsenic, the risk-based concentration is lower than state-specific soil background values, as will be documented in the baseline risk assessment. Consistent with EPA risk assessment guidance (U.S. EPA 1989; RAGs Part A), the state-specific background value will be used as the screening level for arsenic at MGP sites. The source of the selected screening value is presented to the right of the numerical value.

Hierarchy for soil screening criteria:
RSL, then TACO value.
For all TACO soil remediation objectives, the lowest of the two pathway-specific (i.e., ingestion or inhalation) values is used.

RSLs: The industrial soil RSLs were publisehd by EPA June 2017 (https://www.epa.gov/risk/regional-screening-levels-rsls-generic-tables-june-2017).

TACO
Illinois Tiered Approach to Corrective Action Objectives (TACO), soil remediation objectives, Title 35 Part 742 (IEPA 2013c) (http://www.ipcb.state.il.us/SLR/IPCBandIEPAEnvironmentalRegulations-Title35.aspx)

- c – screening value based on cancer effects; calculated values correspond to a cancer risk level of 1 in 1,000,000
- c* – where the non-cancer screening level is < 100× cancer screening level
- d – soil saturation concentration (C_{sat}) – the concentration at which the absorptive limits of the soil particles, the solubility limits of the available soil moisture, and saturation of soil pore air have been reached; above the soil saturation concentration, the assumptions regarding vapor transport to air and/or dissolved phase transport to groundwater (for chemicals which are liquid at ambient soil temperatures) have been violated, and alternative modeling approaches are required.
- m – concentration may exceed ceiling limit
- max – risk-based concentration above ceiling limit, so value was set to ceiling limit (100,000 mg/kg)
- n – screening value based on non-cancer effects; calculated values correspond to a target hazard quotient of 1
- s – concentration may exceed C_{sat} (soil saturation concentration)
- sat – risk-based concentration exceeded soil saturation concentration (C_{sat}), so value was set to C_{sat}.
- r – value based on dietary reference dose
- t – values for counties within metropolitan statistical area (13.0 mg/kg) and outside metropolitan statistical area (11.3 mg/kg) from 742.Appendix A, Table G [Concentrations of Inorganic Chemicals in Background Soil
- w – value based on reference dose adjusted for dietary intake
- x – for any populated areas as defined in Section 742.200, Appendix A, Table H may be used
- y – value based on maintaining fetal blood lead below 10 μg/dL, using the USEPA Adult Blood Lead Model

[1] Concentrations are the Illinois background concentrations for arsenic from TACO. Values for counties within metropolitan statistical area (13.0 mg/kg) and outside metropolitan statistical area (11.3 mg/kg) are taken from IEPA 2013c, 742.Appendix A, Table G [Concentrations of Inorganic Chemicals in Background Soils].

Table 5. Construction worker soil screening levels for MGP sites in Illinois
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Analyte	CAS #	Selected Concentration Soil Construction Worker (mg/kg)	Source	Comments	Soil Saturation Concentration C_{sat} (mg/kg)	IEPA (2013c) TACO Remediation Objective Soil, Construction worker Ingestion (mg/kg)	IEPA (2013c) TACO Remediation Objective Soil, Construction worker Inhalation (mg/kg)	IEPA (2017) Non-TACO Remediation Objective Soil, Construction Worker Ingestion (mg/kg)	IEPA (2017) Non-TACO Remediation Objective Soil, Construction Worker Inhalation (mg/kg)
Semivolatile Organic Compounds									
Polycyclic Aromatic Hydrocarbons									
Acenaphthene	83-32-9	100,000 n	max		--	120,000 nm	--	--	--
Acenaphthylene	208-96-8	61,214 n	non-TACO		--	--		61,214 n	--
Anthracene	120-12-7	100,000 n	max		--	610,000 nm	--	--	--
Benzo[a]anthracene	56-55-3	170 c	TACO		--	170 c	--	--	--
Benzo[a]pyrene	50-32-8	17 c	TACO		--	17 c	--	--	--
Benzo[b]fluoranthene	205-99-2	170 c	TACO		--	170 c	--	--	--
Benzo[g,h,i]perylene	191-24-2	61,214 n	non-TACO		--	--	--	61,214 n	--
Benzo[k]fluoranthene	207-08-9	1,700 c	TACO		--	1,700 c	--	--	--
Chrysene	218-01-9	17,000 c	TACO		--	17,000 c	--	--	--
Dibenz[a,h]anthracene	53-70-3	17 c	TACO		--	17 c	--	--	--
Fluoranthene	206-44-0	82,000 n	TACO		--	82,000 n	--	--	--
Fluorene	86-73-7	82,000 n	TACO		--	82,000 n	--	--	--
Indeno[1,2,3-cd]pyrene	193-39-5	170 c	TACO		--	170 c	--	--	--
2-Methylnaphthalene	91-57-6	816 n	non-TACO		--	--	--	816 n	--
Naphthalene	91-20-3	2 n	TACO		--	4,100 n	2 n	--	--
Phenanthrene	85-01-8	61,214 n	non-TACO		--	--	--	61,214 n	--
Pyrene	129-00-0	61,000 n	TACO		--	61,000 n	--	--	--
Phenols									
2,4-Dimethylphenol	105-67-9	41,000 n	TACO		--	41,000 n	--	--	--
2-Methylphenol (o-Cresol)	95-48-7	100,000 n	TACO		--	100,000 n	--	--	--
3&4-Methylphenol (m&p)	108-39-4	100,000 n	max	Value for m-cresol (108-39-4)	--	--	--	102,023 nm	104,098,000 nfm
Phenol	108-95-2	61,000 n	TACO		--	61,000 n	--	--	--
Volatile Organic Compounds									
Benzene	71-43-2	2.2 c	TACO		1820	2,300 cs	2 c	--	--
Ethylbenzene	100-41-4	58 n	TACO		480	20,000 ns	58 n	--	--
Toluene	108-88-3	42 n	TACO		818	410,000 nms	42 n	--	--
1,2,4-Trimethylbenzene	95-63-6	219 sat	sat		219	--	--	8,162 ns	221 nos
1,3,5-Trimethylbenzene	108-67-8	182 sat	sat		182	--	--	8,162 ns	185 nos
m&p-Xylene	108-38-3	6.4 n	TACO		--	41,000 n	6 n	--	--
o-Xylene	95-47-6	6.5 n	TACO		434	41,000 ns	7 n	--	--
Xylene (Total)	1330-20-7	5.6 n	TACO		260	41,000 ns	6 n	--	--
Metals and Inorganics									
Aluminum	7429-90-5	100,000 n	max		--	--	--	204,045 nm	867,483 nfm
Antimony	7440-36-0	82 n	TACO		--	82 n	--	--	--
Arsenic	7440-38-2	61 n	TACO		--	61 n	25,000 c	--	--
Barium	7440-39-3	14,000 n	TACO		--	14,000 n	870,000 nm	--	--
Cadmium	7440-43-9	200 n	TACO		--	200 n	59,000 c	--	--
Chromium	7440-47-3	690 n	TACO	Value for Chromium total	--	4,100 n	690 n	--	--
Copper	7440-50-8	8,200 n	TACO		--	8,200 n	--	--	--
Iron	7439-89-6	100,000 n	max		--	--	--	142,832 nm	--
Lead	7439-92-1	700 n	TACO		--	700 n	--	--	--
Manganese	7439-96-5	4,100 n	TACO		--	4,100 n	8,700 n	--	--
Mercury	7487-94-7	61.0 ni	TACO		--	61 n	0.1 n	--	--
Nickel	7440-02-0	4,100 n	TACO		--	4,100 n	440,000 cm	--	--
Selenium	7782-49-2	1,000 n	TACO		--	1,000 n	--	--	--
Silver	7440-22-4	1,000 n	TACO		--	1,000 n	--	--	--
Vanadium	7440-62-2	1,400 n	TACO		--	1,400 n	--	--	--
Zinc	7440-66-6	61,000 n	TACO		--	61,000 n	--	--	--
Cyanide	143-33-9	4,100 n	TACO		--	4,100	--	--	--

(footnotes on following page)

Table 5. Construction worker soil screening levels for MGP sites in Illinois
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Notes: This table provides the selected screening value for each analyte for a construction worker. If the risk-based concentration exceeds either the soil saturation concentration (Csat) or the ceiling limit of 100,000 mg/kg, the appropriate value replaces the risk-based concentration as the screening level.

Hierarchy for soil screening criteria:
TACO, then non-TACO value.
For all TACO and non-TACO soil screening levels, the lowest of the two pathway-specific (i.e., ingestion or inhalation) values is used.

TACO and non-TACO
Illinois Tiered Approach to Corrective Action Objectives (TACO), soil remediation objectives, Title 35 Part 742 (IEPA 2013c) (http://www.ipcb.state.il.us/SLR/IPCBandIEPAEnvironmentalRegulations-Title35.aspx)
Illinois non-TACO construction worker soil remediation objectives calculated using IEPA guidelines (IEPA 2017) (http://www.epa.illinois.gov/topics/cleanup-programs/taco/index) and the most current subchronic toxicity values for non-TACO chemicals provided therein (web-based guidance accessed February 23, 2017).

c	– screening value based on cancer effects; calculated values correspond to a cancer risk level of 1 in 1,000,00(
f	-calculated value based on equations for inhalation exposure route - fugitive dust (TACO- Section 742.Table A:SSL Equation)
i	- the ingestion value is used for mercury as it is for a mercury salt. The lower inhalation value of 0.1 mg/kg is for elemental mercury, which is not a form of mercury associated with former MGP operations.
m	– concentration may exceed ceiling limit
max	– risk-based concentration above ceiling limit, so value was set to ceiling limit (100,000 mg/kg)
n	– screening value based on non-cancer effects; calculated values correspond to a target hazard quotient of 1
o	- calculated value based on equations for inhalation exposure route - organic contaminants (TACO- Section 742.Table A:SSL Equation)
sat	- risk-based screening level exceeds the chemical saturation limit in soil, and so the saturation limit was used as the selected screening level.
s	– concentration may exceed C_{sat} (soil saturation concentration)

Table 6. Groundwater screening levels for MGP sites in Wisconsin
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Analyte	CAS #	Screening Criteria: U.S. EPA (2017) RSL Tapwater (µg/L)	Screening Criteria: U.S. EPA (2009) Maximum Contaminant Level (µg/L)	Screening Criteria: WDNR (2015) NR140 Groundwater Enforcement Standard (µg/L)	Comments
Semivolatile Organic Compounds					
Polycyclic Aromatic Hydrocarbons					
Acenaphthene	83-32-9	530 n	--	--	
Acenaphthylene	208-96-8	530 n	--	--	Used surrogate of acenaphthene (83-32-9)
Anthracene	120-12-7	1,800 n	--	3,000	
Benzo[a]anthracene	56-55-3	0.03 c	--	--	
Benzo[a]pyrene	50-32-8	0.025 c	0.2	0.2	
Benzo[b]fluoranthene	205-99-2	0.25 c	--	0.2	
Benzo[g,h,i]perylene	191-24-2	120 n	--	--	Used surrogate of pyrene (129-00-0)
Benzo[k]fluoranthene	207-08-9	2.5 c	--	--	
Chrysene	218-01-9	25 c	--	0.2	
Dibenz[a,h]anthracene	53-70-3	0.025 c	--	--	
Fluoranthene	206-44-0	800 n	--	400	
Fluorene	86-73-7	290 n	--	400	
Indeno[1,2,3-cd]pyrene	193-39-5	0.25 c	--	--	
2-Methylnaphthalene	91-57-6	36 n	--	--	
Naphthalene	91-20-3	0.17 c*	--	100	
Phenanthrene	85-01-8	1,800 n	--	--	Used surrogate of anthracene (120-12-7)
Pyrene	129-00-0	120 n	--	250	
Phenols					
2,4-Dimethylphenol	105-67-9	360 n	--	--	
3&4-Methylphenol (m&p)	108-39-4	930 n	--	--	Used value for m-cresol (108-39-4)
2-Methylphenol (o-Cresol	95-48-7	930 n	--	--	
Phenol	108-95-2	5,800 n	--	2,000	
Volatile Organic Compounds					
Benzene	71-43-2	0.46 c*	5	5	
Ethylbenzene	100-41-4	1.5 c	700	700	
Toluene	108-88-3	1,100 n	1,000	800	
1,2,4-Trimethylbenzene	95-63-6	56 n	--	--	
1,3,5-Trimethylbenzene	108-67-8	60 n	--	--	
m&p-Xylene	108-38-3	190 n	--	--	Used value for m-xylene (108-38-3)
o-Xylene	95-47-6	190 n	--	--	
Xylene (total)	1330-20-7	190 n	10,000	2,000	
Metals and Inorganics					
Aluminum	7429-90-5	20,000 n	--	200	
Antimony	7440-36-0	7.8 n	6	6	
Arsenic	7440-38-2	0.052 c	10	10	
Barium	7440-39-3	3,800 n	2,000	2,000	
Cadmium	7440-43-9	9.2 n	5	5	
Chromium	7440-47-3	22,000 n	100	100	For MCL: Cr (total); For RSL: Cr(III)
Copper	7440-50-8	800 n	1,300	1,300	
Iron	7439-89-6	14,000 n	--	--	
Lead	7439-92-1	15	15	15	
Manganese	7439-96-5	430 n	--	300	
Mercury	7487-94-7	5.7 n	2	2	For RSL: mercuric chloride (& other Hg salts)
Nickel	7440-02-0	390 n	--	100	For RSL: nickel soluble salts
Selenium	7782-49-2	100 n	50	50	
Silver	7440-22-4	94 n	--	50	
Vanadium	7440-62-2	86 n	--	30	
Zinc	7440-66-6	6,000 n	--	--	
Cyanide	57-12-5	20 n[1]	200 [1]	200 [1]	For RSL: sodium cyanide; For WI: cyanide, free

Notes: Site concentrations will be screened separately against all three sets of criteria. Any analyte exceeding any criteria will be considered a chemical of potential concern.

RSLs: The tapwater RSLs were publisehd by EPA June 2017 (https://www.epa.gov/risk/regional-screening-levels-rsls-generic-tables-june-201

MCLs: Maximum Contaminant Levels (MCL) national primary drinking water standards (U.S. EPA 2009 (http://water.epa.gov/drink/contaminants/index.cfm)

WI NR140: WI NR 140 groundwater quality enforcement standards published in Register 715, dated July 2015 (WDNR 2015 (http://docs.legis.wisconsin.gov/code/admin_code/nr/140.pdf)

c – screening value based on cancer effects; calculated values correspond to a cancer risk level of 1 in 1,000,000
c* – where the non-cancer screening level is < 100× cancer screening level
n – screening value based on non-cancer effects; calculated values correspond to a target hazard quotient of 1

Table 7. Groundwater screening levels for MGP sites in Illinois
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Analyte	CAS #	Screening Criteria: U.S. EPA (2017) RSL Tapwater (µg/L)	Screening Criteria: U.S. EPA (2009) Maximum Contaminant Level (µg/L)	Screening Criteria: Selected Illinois Groundwater Value[1] (µg/L)	IEPA (2013d) Illinois Groundwater Quality Standard Class I (µg/L)	IEPA (2013c) TACO Remediation Objective, Class I Groundwater (µg/L)	IEPA (2016) Non-TACO Remediation Objective, Class I Groundwater (µg/L)	Comments
Semivolatile Organic Compounds								
Polycyclic Aromatic Hydrocarbons								
Acenaphthene	83-32-9	530 n	--	420 QS	420	420	--	
Acenaphthylene	208-96-8	530 n	--	210 non-TACO	--	--	210	Used surrogate of acenaphthene (83-32-9) for RSL
Anthracene	120-12-7	1,800 n	--	2,100 QS	2,100	2,100	--	
Benzo[a]anthracene	56-55-3	0.03 c	--	0.13 QS	0.13	0.13	--	
Benzo[a]pyrene	50-32-8	0.025 c	0.2	0.2 QS	0.2	0.2	--	
Benzo[b]fluoranthene	205-99-2	0.25 c	--	0.18 QS	0.18	0.18	--	
Benzo[g,h,i]perylene	191-24-2	120 n	--	210 non-TACO	--	--	210	Used surrogate of pyrene (129-00-0) for RSL
Benzo[k]fluoranthene	207-08-9	2.5 c	--	0.17 QS	0.17	0.17	--	
Chrysene	218-01-9	25 c	--	12 QS	12	1.5	--	
Dibenz[a,h]anthracene	53-70-3	0.025 c	--	0.3 QS	0.3	0.3	--	
Fluoranthene	206-44-0	800 n	--	280 QS	280	280	--	
Fluorene	86-73-7	290 n	--	280 QS	280	280	--	
Indeno[1,2,3-cd]pyrene	193-39-5	0.25 c	--	0.43 QS	0.43	0.43	--	
2-Methylnaphthalene	91-57-6	36 n	--	28 QS	28	--	28	
Naphthalene	91-20-3	0.17 c*	--	140 QS	140	140	--	
Phenanthrene	85-01-8	1,800 n	--	210 non-TACO	--	--	210	Used surrogate of anthracene (120-12-7) for RSL
Pyrene	129-00-0	120 n	--	210 QS	210	210	--	
Phenols								
2,4-Dimethylphenol	105-67-9	360 n	--	140 TACO	--	140	--	
2-Methylphenol (o-Cresol)	95-48-7	930 n	--	350 QS	350	350	--	
3&4-Methylphenol (m&p)	108-39-4	930 n	--	350 non-TACO	--	--	35	Used value for m-cresol (108-39-4)
Phenol	108-95-2	5,800 n	--	100 QS	100	100	--	
Volatile Organic Compounds								
Benzene	71-43-2	0.46 c*	5	5 QS	5	5	--	
Ethylbenzene	100-41-4	1.5 c	700	700 QS	700	700	--	
Toluene	108-88-3	1,100 n	1,000	1,000 QS	1,000	1,000	--	
1,2,4-Trimethylbenzene	95-63-6	56 n	--	70 non-TACO	--	--	70	
1,3,5-Trimethylbenzene	108-67-8	60 n	--	70 non-TACO	--	--	70	
m&p-Xylene	108-38-3	190 n	--	--	--	--	--	Used value for m-xylene (108-38-3) for RSL
o-Xylene	95-47-6	190 n	--	--	--	--	--	
Xylene (total)	1330-20-7	190 n	10,000	10,000 QS	10,000	10,000	--	
Metals and Inorganics								
Aluminum	7429-90-5	20,000 n	--	3,500 non-TACO	--	--	3,500	
Antimony	7440-36-0	7.8 n	6	6 QS	6	6	--	
Arsenic	7440-38-2	0.052 c	10	10 QS	10	50	--	
Barium	7440-39-3	3,800 n	2,000	2,000 QS	2,000	2,000	--	
Cadmium	7440-43-9	9.2 n	5	5 QS	5	5	--	
Chromium	7440-47-3	22,000 n	100	100 QS	100	100	--	For MCL: Cr (total); For RSL: Cr(III)
Copper	7440-50-8	800 n	1,300	650 QS	650	650	--	
Iron	7439-89-6	14,000 n	--	5,000 QS	5,000	5,000	--	
Lead	7439-92-1	15	15	7.5 QS	7.5	7.5	--	
Manganese	7439-96-5	430 n	--	150 QS	150	150	--	
Mercury	7487-94-7	5.7 n	2	2 QS	2	2	--	For RSL: mercuric chloride (& other Hg salts)
Nickel	7440-02-0	390 n	--	100 QS	100	100	--	For RSL: nickel soluble salts
Selenium	7782-49-2	100 n	50	50 QS	50	50	--	
Silver	7440-22-4	94 n	--	50 QS	50	50	--	
Vanadium	7440-62-2	86 n	--	49 QS	49	49	--	
Zinc	7440-66-6	6,000 n	--	5,000 QS	5,000	5,000	--	
Cyanide	57-12-5	20 n[2]	200 [2]	200 QS[2]	200	200	--	For RSL: sodium cyanide (143-33-9)

(footnotes on following page)

Table 7. Groundwater screening levels for MGP sites in Illinois
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Notes: Site concentrations will be screened separately against all three sets of criteria. Any analyte exceeding any criteria will be considered a chemical of potential concern.

RSLs: The tapwater RSLs were publisehd by EPA June 2017 (https://www.epa.gov/risk/regional-screening-levels-rsls-generic-tables-june-2017).

MCLs: Maximum Contaminant Levels (MCL) national primary drinking water standards (U.S. EPA 2009) (http://water.epa.gov/drink/contaminants/index.cfm)

Illinois standards or objectives

Illinois Groundwater Quality Standards for Class I: Potable Resource, Title 35 Part 620 (IEPA 2013d) (www.ipcb.state.il.us/SLR/IPCBandIEPAEnvironmentalRegulations-Title35.aspx)
Illinois Tiered Approach to Corrective Action Objectives (TACO), groundwater remediation objectives, Title 35 Part 742 (IEPA 2013c) (www.ipcb.state.il.us/SLR/IPCBandIEPAEnvironmentalRegulations-Title35.aspx)
Illinois non-TACO objectives (IEPA 2016) (www.epa.state.il.us/land/taco/chemicals-not-in-taco-tier-1-tables.html)

c – screening value based on cancer effects; calculated values correspond to a cancer risk level of 1 in 1,000,000
c* – where the non-cancer screening level is < 100× cancer screening level
n – screening value based on non-cancer effects; calculated values correspond to a target hazard quotient of 1
non-TACO – value is the Illinois non-TACO objective
QS – value is the Illinois groundwater quality standard
TACO – value is the Illinois TACO groundwater remediation objective

[1] Hierarchy for selected Illinois groundwater screening criteria: Groundwater quality standard, then TACO remediation objective, then non-TACO remediation objective.
[2] Groundwater cyanide concentration results based on the available cyanide analysis method (OIA 1677) will be compared to cyanide groundwater criterion.

Table 8. Residential vapor intrusion screening levels for MGP sites in Illinois and Wisconsin
RAF Addendum (Revision 6)

Analyte	CAS #	Selected Risk-Based Concentrations, Residential: Indoor Air RSL (µg/m^3)	Soil Gas (µg/m^3)	Groundwater, Vapor Intrusion (µg/L)	Comments for Selected Value	U.S. EPA (2009) Maximum Contaminant Level (µg/L)
Semivolatile Organic Compounds						
Polycyclic Aromatic Hydrocarbons						
Naphthalene	91-20-3	0.083 c*	2.8 c	4.6 c		--
Volatile Organic Compounds						
Benzene	71-43-2	0.36 c	12 c	1.6 c	MCL is higher than groundwater VI value	5
Ethylbenzene	100-41-4	1.1 c	37 c	3.5 c	MCL is higher than groundwater VI value	700
Toluene	108-88-3	5,200 n	170,000 n	19,000 n		1,000
1,2,4-Trimethylbenzene	95-63-6	63 n	2,100 n	250 n		--
1,3,5-Trimethylbenzene	108-67-8	63 n	2,100 n	250 n	Used RfC for 1,2,4-trimethylbenzene	--
m&p-Xylene	108-38-3	100 n	3,500 n	360 n	Used value for m-xylene (108-38-3)	--
o-Xylene	95-47-6	100 n	3,500 n	490 n		--
Xylene (total)	1330-20-7	100 n	3,500 n	380 n	MCL is higher than groundwater VI value	10,000

Notes:

The vapor intrusion soil gas and groundwater screening values are based on the indoor air RSL, and derived using EPA's Vapor Instrusion Screening Level (VISL) Calculator, Version 3.5.1 dated July 2016. As appropriate the VISLs were updated using the most current indoor air RSL published by EPA in June 2017.

Chemicals listed on Table 1 of the RAF (Exponent 2007) that are considered vapor intrusion (VI) chemicals of potential of concern (COPC) are listed on this table. Whether a chemical is considered a VI COPC is based on the EPAs VISL calculator designation with the exception of benzo[a]anthracene. Benzo[a]anthracene is considered a VI COPC under the residential scenario if a risk target of 1x10-6 is selected within the VISL calculator. However, as agreed to with EPA for the Multi-site MGP Program this analyte is not considered a VI COPC.

The groundwater vapor intrusion values are based on a default groundwater temperature of 25ºC. Only analytes that are sufficiently volatile and have available inhalation toxicity values are presented.

RSLs: The indoor air RSLs presented in this table were developed utilizing EPA's RSL Calculator (https://epa-prgs.ornl.gov/cgi-bin/chemicals/csl_search) and the EPA default exposure assumptions for the residential receptor available as of April 24, 2017.

MCLs: Maximum Contaminant Levels (MCL) national primary drinking water standards (U.S. EPA 2009) (http://water.epa.gov/drink/contaminants/index.cfm)

c – screening value based on cancer effects; calculated values correspond to a cancer risk level of 1 in 1,000,000
c* – where the non-cancer screening level is < 100× cancer screening level
n – screening value based on non-cancer effects; calculated values correspond to a target hazard quotient of 1
NVT – not sufficiently volatile and/or toxic to pose inhalation risk in selected exposure scenario for the indicated medium
RfC – reference concentration
VI – vapor intrusion

Table 9. Industrial vapor intrusion screening levels for MGP sites in Illinois and Wisconsin
RAF Addendum (Revision 6)

Analyte	CAS #	Selected Risk-Based Concentrations, Industrial: Indoor Air RSL (µg/m^3)	Soil Gas (µg/m^3)	Groundwater, Vapor Intrusion (µg/L)	Comments for Selected Value	U.S. EPA (2009) Maximum Contaminant Level (µg/L)
Semivolatile Organic Compounds						
Polycyclic Aromatic Hydrocarbons						
Naphthalene	91-20-3	0.36 c*	12 c	20 c		--
Volatile Organic Compounds						
Benzene	71-43-2	1.6 c*	52 c	6.9 c		5
Ethylbenzene	100-41-4	4.9 c	160 c	15 c	MCL is higher than groundwater VI value	700
Toluene	108-88-3	22,000 n	730,000 n	81,000 n		1,000
1,2,4-Trimethylbenzene	95-63-6	260 n	8,667 n	1,032 n		--
1,3,5-Trimethylbenzene	108-67-8	260 n	8,667 n	1,032 n	Used RfC for 1,2,4-trimethylbenzene	--
m&p-Xylene	108-38-3	440 n	15,000 n	1,500 n	Used value for m-xylene (108-38-3)	--
o-Xylene	95-47-6	440 n	15,000 n	2,100 n		--
Xylene (total)	1330-20-7	440 n	15,000 n	1,600 n	MCL is higher than groundwater VI value	10,000

Notes:

The vapor intrusion soil gas and groundwater screening values are based on the indoor air RSL, and derived using EPA's Vapor Instrusion Screening Level (VISL) Calculator, Version 3.5.1 dated July 2016. As appropriate the VISLs were updated using the most current indoor air RSL published by EPA in June 2017.

Chemicals listed on Table 1 of the RAF (Exponent 2007) that are considered vapor intrusion (VI) chemicals of potential of concern (COPC) are listed on this table. Whether a chemical is considered a VI COPC is based on the EPAs VISL calculator designation with the exception of benzo[a]anthracene. Benzo[a]anthracene is considered a VI COPC under the residential scenario if a risk target of 1x10-6 is selected within the VISL calculator. However, as agreed to with EPA for the Multi-site MGP Program this analyte is not considered a VI COPC.

The groundwater vapor intrusion values are based on a default groundwater temperature of 25ºC. Only analytes that are sufficiently volatile and have available inhalation toxicity values are presented.

RSLs: The indoor air RSLs presented in this table were developed utilizing EPA's RSL Calculator (https://epa-prgs.ornl.gov/cgi-bin/chemicals/csl_search) and the EPA default exposure assumptions for the industrial worker receptor available as of April 24, 2017.

MCLs: Maximum Contaminant Levels (MCL) national primary drinking water standards (U.S. EPA 2009) (http://water.epa.gov/drink/contaminants/index.cfm)

c – screening value based on cancer effects; calculated values correspond to a cancer risk level of 1 in 1,000,000
c* – where the non-cancer screening level is < 100× cancer screening level
n – screening value based on non-cancer effects; calculated values correspond to a target hazard quotient of 1
NVT – not sufficiently volatile and/or toxic to pose inhalation risk in selected exposure scenario for the indicated medium
RfC – reference concentration
VI – vapor intrusion